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| 10/084,962 | 02/27/2002 | Daniel J. Woodruff | 114183-007 | 2206 |

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| EXAMINER |
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ZHENG, LOIS L

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| ART UNIT | PAPER NUMBER |
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1742

DATE MAILED: 03/29/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/084,962

Applicant(s)

WOODRUFF ET AL.

Examiner

Lois Zheng

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 January 2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 17-34 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 17-34 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

DETAILED ACTION

Status of Claims

1. Claims 17-34 are currently under examination.

Status of Previous Rejections

2. The Declaration under 37 CFR 1.132 filed 13 January 2006 is sufficient to overcome the rejection of claims 17-34 based upon Wang.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 17 and 21-22 are rejected under 35 U.S.C. 102(b) as being anticipated by Lowery US 5,670,034(Lowery).

The teachings of Lowery are discussed in paragraph 4 of the previous Non-Final Office Action mailed 14 July 2005. The rejection ground is maintained for the same reasons as stated in paragraph 4 of the previous Non-Final Office Action.

5. Claims 17, 21-22 and 24-32 are rejected under 35 U.S.C. 102(b) as being anticipated by Van Raalte et al. US 3,880,725(Van Raalte).

Van Raalte teaches an electroplating apparatus comprising a plurality of anodes (Fig. 2 numeral 116), a cathode in contact with a wafer(Fig. 2 numeral 112), a power source capable providing independently controlled current to each of the plurality of

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anodes(abstract, col. 3 line 55 – col. 4 line 35). Van Raalte further teaches a metallic solution for electroplating(col. 2 lines 29-32).

Regarding claims 17, 21-22 and 30-32, the electroplating apparatus of Van Raalte inherently contains the claimed plurality of leads and is inherently capable of providing different current levels to different anodes, including providing a higher current at the inner portion of wafer and a lower current at the outer portion of the wafer as claimed.

Regarding claims 24-29, the claimed limitations relate to how the power source is operated, therefore, is construed as a process limitation, which does not lend patentability to the instant apparatus claimed. As stated in MPEP 2114 [R-1], it is well settled that the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus as long as the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

6. Claims 17-22 and 24-34 are rejected under 35 U.S.C. 102(b) as being anticipated by Inagaki JP 59-150094(Inagaki).

Inagaki teaches an electroplating apparatus comprising a cup-shaped plating reactor vessel for holding the metallic plating solution, a workpiece being positioned in transverse relationship to the center axis of the plating vessel, a plurality of concentrically arranged anodes perpendicular to the center axis of the plating vessel and separated by dielectric partition walls(Fig. 9, numerals 17, 13, 41-43, 45). Inagaki

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further teaches that the concentrically positioned anodes are independently connected to separate power sources(Fig. 9 numerals 38-40).

Regarding claims 17-22 and 30-32, the apparatus of Inagaki is inherently capable of providing various levels of voltage to different anodes as claimed. The claimed plurality of leads is inherently present in the apparatus of Inagaki in order to connect each of the anodes to separate power sources as taught by Inagaki. Inagaki further teaches the claimed cathode contact electrically coupled to the wafer(Fig. 9, numeral 35).

Regarding claims 24-29, the claimed limitations relate to how the power source is operated, therefore, is construed as a process limitation, which does not lend patentability to the instant apparatus claimed. As stated in MPEP 2114 [R-1], it is well settled that the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus as long as the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 17-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirohiko JP 04-311591(Hirohiko).

Hirohiko teaches an electroplating apparatus comprises a plurality of concentric anodes(Fig. 1 numeral 4) separated by dielectric walls(Figs. 1-2, numeral 121), a cathode(Fig.1 numeral 3). Hirohiko further teaches a metallic plating solution(page 17, [0027]) and a power source couple to the anodes and the cathode(pages 11-12,[0017-0019]).

Regarding claim 1, even though Hirohiko does not explicitly teach that the power source is capable of providing variable current to the claimed primary and secondary anodes, one of ordinary skill in the art would have found it obvious to implement a power source capable of providing variable current in order to control the plating speed and uniformity.

Regarding claims 18-20 and 22, the multiple concentric anode rings as taught by Hirohiko read on the claimed primary and secondary anode rings in the electrochemical cell.

Regarding claim 21, the electroplating apparatus of Hirohiko teaches the claimed semiconductor wafer(Fig. 3 numeral 9) coupled to the cathode and receiving a electroplated film on its surfaces.

Regarding claim 23, even though Hirohiko does not explicitly teach the claimed copper plating solution, Hirohiko teaches that its electroplating apparatus can be used to plate any kind of single metal or alloy(page 19 [0029]). One of ordinary skill in the art would have found it obvious to have implement the electroplating apparatus of Hirohiko in plating copper with expected success since copper plating is widely used in semiconductor wafer processing technologies.

Regarding claims 24-29, the claimed limitations relate to how the power source is operated, therefore, is construed as a process limitation, which does not lend patentability to the instant apparatus claimed. As stated in MPEP 2114 [R-1], it is well settled that the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus as long as the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

9. Claims 30-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirohiko in view of Van Raalte.

The teachings of Hirohiko are discussed in paragraph 8 above. However, Hirohiko does not teach the claimed anodes being independently connected to the power source to provide variable current.

The teachings of Van Raalte are discussed in paragraph 5 above.

It would have been obvious to one of ordinary skill in the art to have incorporated the independently controlled power source to anode connections as taught by Van Raalte into the plurality of concentric anodes of Hirohiko in order to achieve more accurate and easy electrodeposition to form a metal film with desired thickness profile(col. 4 lines 7-11, 30-35).

Regarding claims 30-32, the electroplating apparatus of Hirohiko in view of Van Raalte inherently contains the claimed plurality of leads and is inherently capable of providing different current levels to different anodes, including providing a higher current

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at the inner portion of wafer and a lower current at the outer portion of the wafer as claimed.

Regarding claims 33-34, the concentrically positioned anodes as taught by Hirohiko in view of Van Raalte meets the limitations of the claimed anodes.

10. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Inagaki.

The teachings of Inagaki are discussed in paragraph 6 above.

Even though Inagaki does not explicitly teach that the metallic plating solution is a copper solution, one of ordinary skill in the art would have found it obvious to use the apparatus of Inagaki in copper plating with expected success since nickel plating and copper plating uses the same electrochemical plating concept.

Response to Arguments

11. Applicant's arguments regarding Lowery reference filed 13 January 2006 have been fully considered but they are not persuasive.

In the remarks, applicant argues that the feature of the secondary anode as claimed requires the secondary anode to be electrically independent of the primary anode and Lowery does not teach this limitation.

The examiner does not find applicant's argument persuasive since the instant claim 17 only requires that the secondary anode capable of providing variable current to the wafer and does not require that the primary and the secondary anodes to be separately connected and controlled. For example, even though the two anodes as taught by Lowery are commonly connected, they are still inherently capable of providing the claimed variable current to the semiconductor wafer at the same time while being

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commonly connected. Therefore, based on the broadest reasonable interpretation, the examiner maintains that the rejections based on Lowery reference are proper.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lois Zheng whose telephone number is (571) 272-1248. The examiner can normally be reached on 8:30am - 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LLZ

ROY KING
SUPERVISORY PATENT EXAMINER
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